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How does the weather affect the response of porous hose wind noise reduction systems?

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In order to reduce the observation of wind and turbulence on infrasound sensors, wind noise reduction filters are in place at most infrasound stations. The use of such filters is essential to obtain low background noise levels, which in turn facilitates detection of low signal-to-noise (SNR) infrasound signals. Most filters operate by spatially integrating the pressure field in the vicinity of an infrasound sensor. While the turbulent pressure (partially) de-correlates over the spatial length scale of the filter, the infrasound wave remains coherent. Infrasound arrays that are part of the International Monitoring System make use of advanced pipe array structures that have been designed for long-term deployments. The response is of these systems is stable and well understood. In contrast, many experimental infrasound arrays have relied on the use of porous hoses for wind noise reduction. Porous hoses appear to be efficient, yet cost-effective solutions for short term deployments. Over longer timescales, however, it is known that the response of the hoses can vary significantly and that the hoses can degrade over time.

In this work, we investigate the varying response of the porous hoses at the De Bilt Infrasound Array in the Netherlands, using a reference infrasound sensor without hoses. Since a weather station is co-located with the infrasound array, this allows us to study the relationship between the response of the hoses and various meteorological parameters. It is found that under dry conditions, the hoses act as a low-pass filter with a corner frequency around 1.8 Hz, which is consistent with earlier work. We shows that the higher frequency signals with sufficient SNR can be reasonably well reconstructed after a deconvolution step. Under wet conditions however, the hoses become highly absorptive. This can affect observations down to 0.1 Hz. The excess attenuation can be attributed to the presence of rain and/or dew. Although these effects appear to be reversible to some degree, this work shows that care must be taken in the interpretation of data from infrasound arrays that make use of porous hoses.